



EPA GHG Data on Natural Gas and Petroleum Systems

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Overview



- EPA Inventory of U.S. GHG Emissions and Sinks
- EPA Greenhouse Gas Reporting Program
- Updating EPA GHG Estimates



Inventory of U.S. Greenhouse Gas Emissions and Sinks

U.S. Greenhouse Gas Emissions Inventory

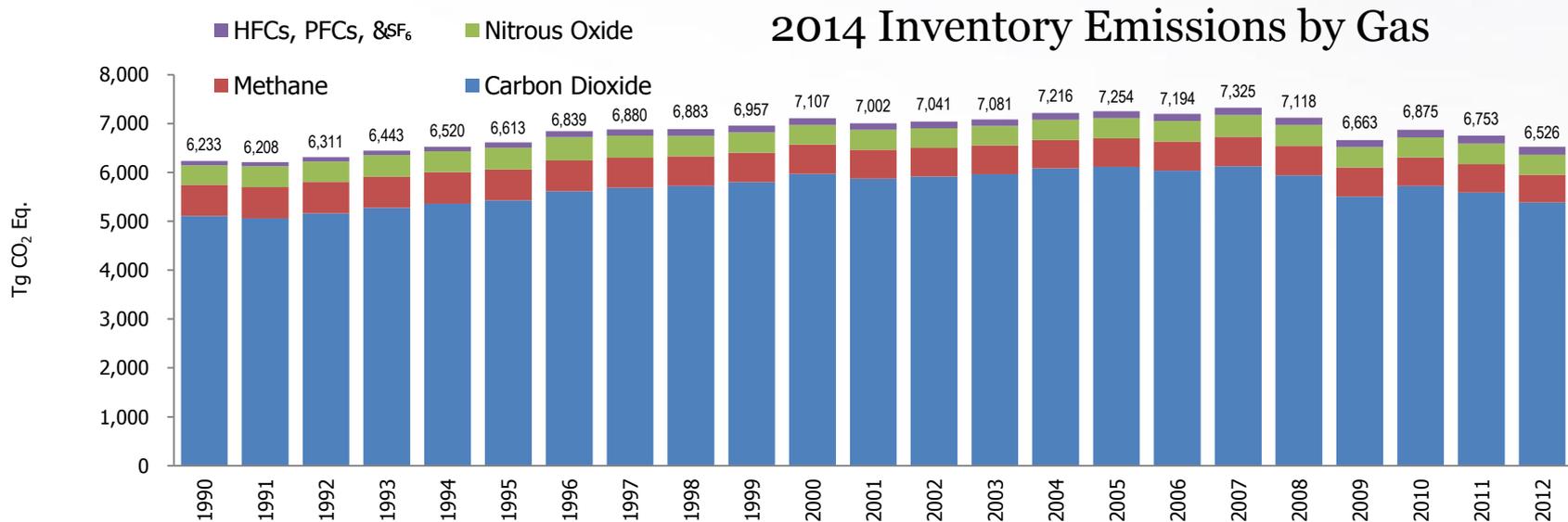


- Annual national-level inventory submissions to the UNFCCC since 1994
- EPA leads Inventory development, working with several agencies
 - e.g. input data on forestry from USFS, data on energy from EIA
- Sectors Covered
 - Energy, Industrial Processes, Agriculture, Land-Use Change and Forestry, and Waste
- Gases Covered
 - CO₂, CH₄, N₂O, HFCs, PFCs, SF₆
 - Include “indirect GHGs” for informational purposes: ozone precursors (CO, NO_x, NMVOCs) & SO₂
 - Reported in Gg of each gas, and as GWP-weighted CO₂e emissions
 - Inventories up to and including current use SAR GWP of 21 for CH₄
 - Future inventories will use AR4 GWP of 25
- Record of emissions trends over time
- Each year, Inventory undergoes expert review, public review, and UNFCCC review

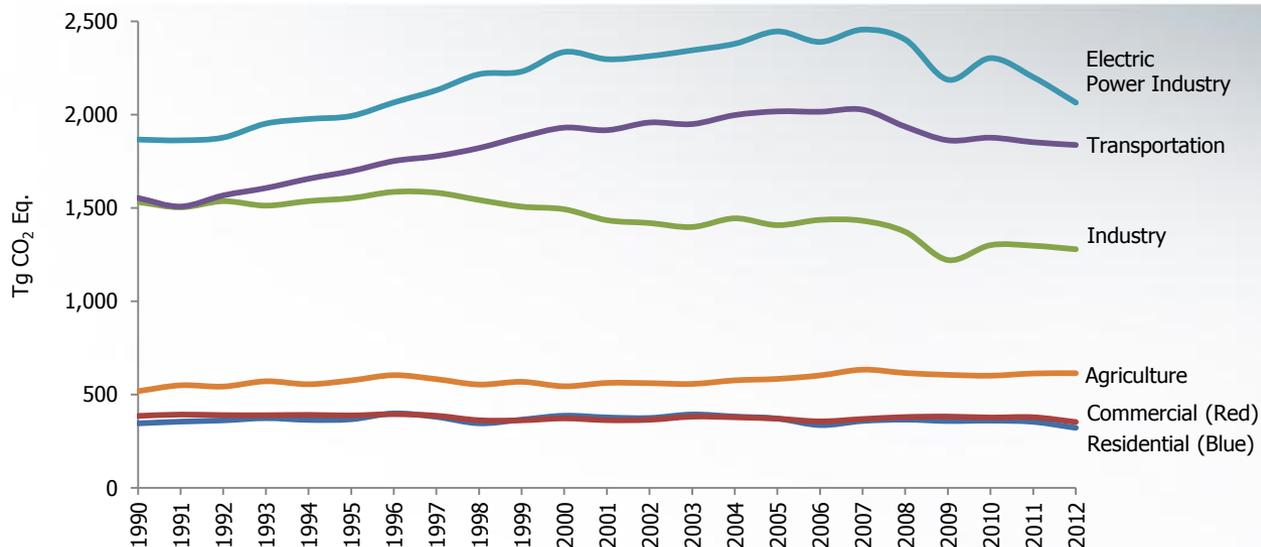
2014 Inventory Results Overview



- US GHG emissions declined 3.4% from 2011 to 2012
 - Increase of 4.7% from 1990, decrease of 10% from 2005
- CO₂ from fuel combustion dominate emissions and trends
 - Major contributors to the 2011-2012 decrease in emissions were decrease in energy consumption across all sectors in the U.S. economy, and decreases in carbon intensity for electricity generation due to fuel switching from coal to natural gas
- Natural gas system emissions are 2% of total GHG emissions

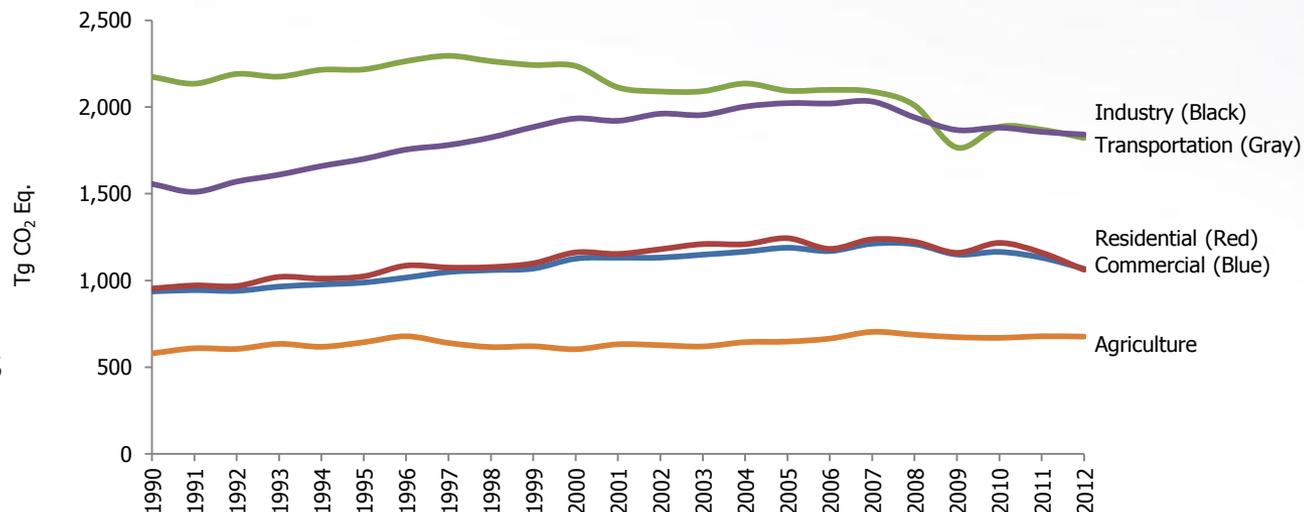


2014 Inventory by Economic Sector



With electric power industry as a separate sector

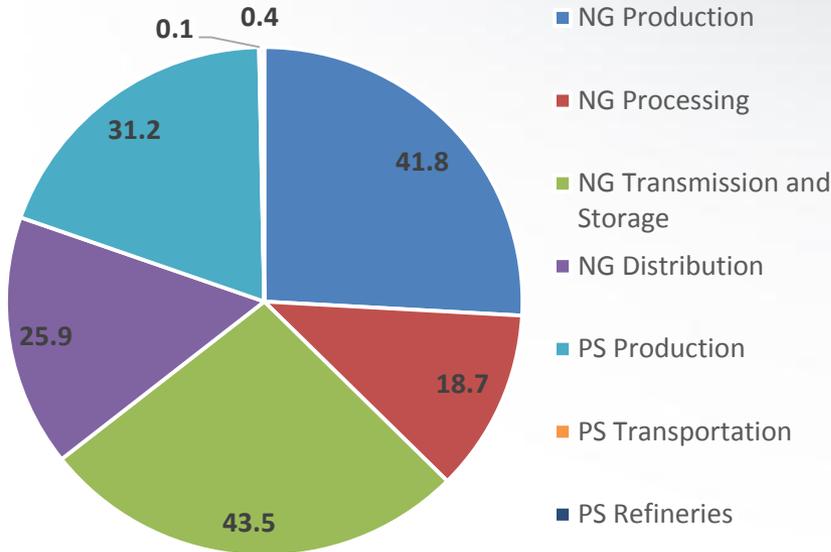
With electric power industry emissions allocated to other sectors by electricity use



Oil and Gas in the Inventory

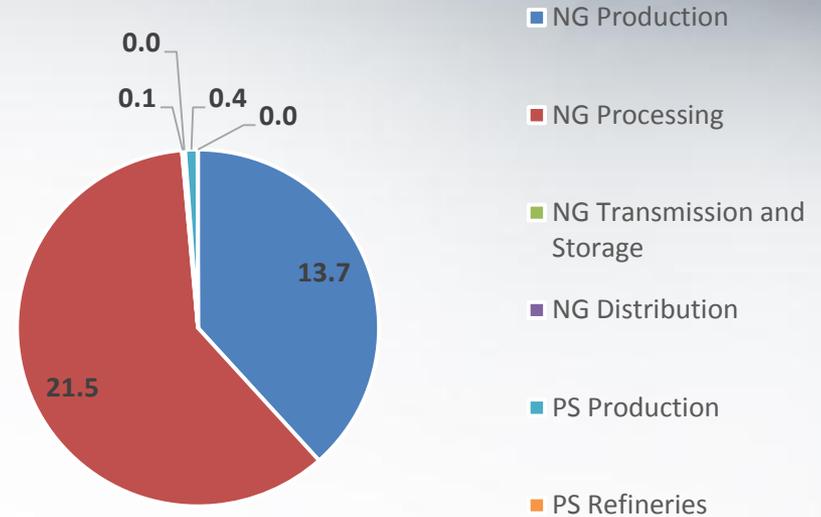


CH₄ Emissions



- NG: 130 Tg CO₂e CH₄
- PS: 32 Tg CO₂e CH₄

CO₂ Emissions



- NG: 35 Tg CO₂e CO₂
- PS: 0.4 Tg CO₂e CO₂

NG = Natural Gas Systems
PS = Petroleum Systems

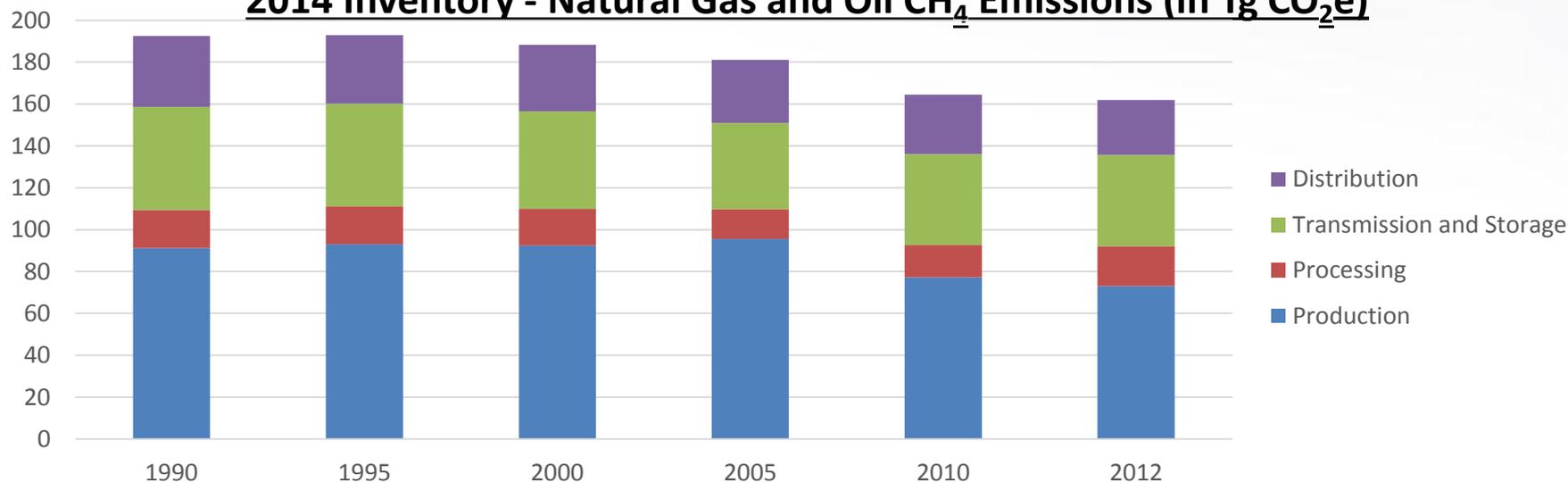
- Figures above includes only process emissions
 - End-use emissions from combustion are included elsewhere (Fossil Fuel Combustion)

Oil and Gas Emission Estimates in the US GHG Inventory



- Oil and gas CH₄ account for 2% of total U.S. GHG emissions, and 29% of U.S. CH₄ emissions
- 162 Tg CO₂e total CH₄ emissions from natural gas systems
 - 73 Tg CO₂e from oil and gas production segments
 - 19 Tg CO₂e from processing segment
 - 43 Tg CO₂e from transmission and storage segment
 - 26 Tg CO₂e from distribution segment
- Emissions decreased 31 Tg CO₂e, or 16%, from 1990-2012
- EPA continues to update estimates to reflect best available information

2014 Inventory - Natural Gas and Oil CH₄ Emissions (in Tg CO₂e)





Calculation of National Emissions

- Approach uses GRI/EPA study with detailed equipment counts, emissions measurements and development of emission factors, updates with recent survey data

Calculation of National Emissions

Step 1. Calculate Potential Methane

- Collect activity data on production and equipment in use and apply emission factors (i.e., scf gas per unit or activity)

Step 2. Compile Reductions Data

- Calculate the amount of the methane that is not emitted, using data on voluntary action and State regulations

Step 3. Calculate Net Emissions

- Deduct methane that is not emitted from the total methane potential estimates to develop net CH₄ emissions

Example: 2012 Emissions from pneumatic devices in transmission sector (2014 Inventory)

Activity Data (# of pneumatics)	Emission Factor (Scf/device)	Calculated Potential (Tg CO ₂ e)	Reductions (Tg CO ₂ e)	Emissions (Tg CO ₂ e)
70,827	x 162,197	= 4.7	- 0.3	= 4.4

Stakeholder Interest



- Many changes in natural gas industry practices in recent years
- Significant interest in GHG emissions estimates from natural gas, in particular the production sector
- EPA receives stakeholder input through expert and public review processes of the GHG Inventory
- Stakeholder Workshop September 2012
- Webinars on GHGRP data and the GHG Inventory, and on proposed update to 2014 Inventory
- Stakeholder data and information has led to recent improvements in GHG Inventory estimates

Updating GHG Inventory Estimates



EPA's standard process is to update the Inventory when improved data are available to improve emissions calculations.

Inventory Year	Update to GHG Inventory Natural Gas Systems Estimate
Inventories through 2010	GHG estimates for all activities were based on a 1996 GRI/EPA study (1992 data)
2011/2012 Inventories	EPA updated the natural gas production sector estimates <ul style="list-style-type: none">• Updated estimates of liquids unloading using engineering calculations• Included hydraulically fractured gas well completions/workovers
2013 Inventory	EPA updated the natural gas estimates for the production sector based on new data <ul style="list-style-type: none">• Further improvements to liquids unloading estimates using API/ANGA study• Updated hydraulic fracturing gas well completions/workovers estimates to be consistent with NSPS analysis
2014 Inventory	<ul style="list-style-type: none">• Update to approach for estimating emissions from hydraulically fractured gas well completions/workovers• Use of 4 practice-specific emission factors



Greenhouse Gas Reporting Program

Overview of GHG Reporting Program



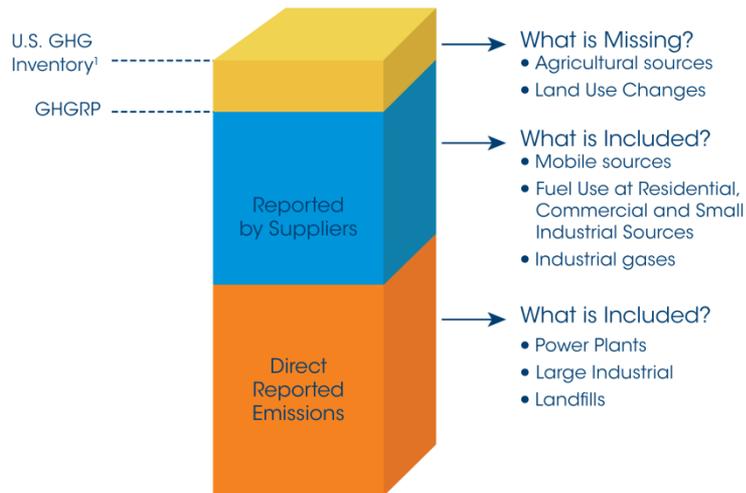
- Launched in response to FY 2008 Consolidated Appropriations Act
- Annual reporting of GHGs by 41 source categories
 - 33 types of direct emitters
 - 6 types of suppliers of fuel and industrial GHGs
 - Facilities that inject CO₂ underground for geologic sequestration, enhanced oil recovery, or any other purpose
- Most source categories began collecting data in 2010, with first annual reports submitted to EPA in September 2011
 - An additional 12 source categories began collecting data in 2011, with first annual reports submitted to EPA in September 2012
 - We now have published 3 years of data for 29 source categories and 2 years of data for 12 source categories
- Facilities use uniform methods prescribed by the EPA to calculate GHG emissions, such as direct measurement, engineering calculations, or emission factors derived from direct measurement
 - In some cases, facilities have a choice of calculation methods for an emission source
- Direct reporting to EPA electronically
- EPA verification of GHG data

GHG Reporting Program vs. US GHG Inventory



- Inventory of U.S. Greenhouse Gas Emissions and Sinks (Inventory) tracks total annual U.S. emissions across all sectors of the economy using national-level data
- GHGRP collects detailed emissions data from large greenhouse gas emitting facilities in the United States
 - GHGRP covers most, but not all, U.S. GHG emissions
 - GHGRP does not include agriculture, land use, and small sources

GHGRP Covers the Majority of U.S. GHG Emissions



¹ Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2011, April 2013.

Task	Inventory	Greenhouse Gas Reporting Program
Find total U.S. emissions	✓	
Review trend data for the past 20 years	✓	
Browse a map to find largest emitters in your area		✓
Compare facility emissions across an industrial sector		✓
Find <u>reported</u> emissions by state		✓

Petroleum and Natural Gas Systems in GHGRP (Subpart W)



Production and Processing

1. Onshore Production
- 2a, 2b. Offshore Production
3. Gathering and Boosting (not covered by Subpart W)
4. Natural Gas Processing



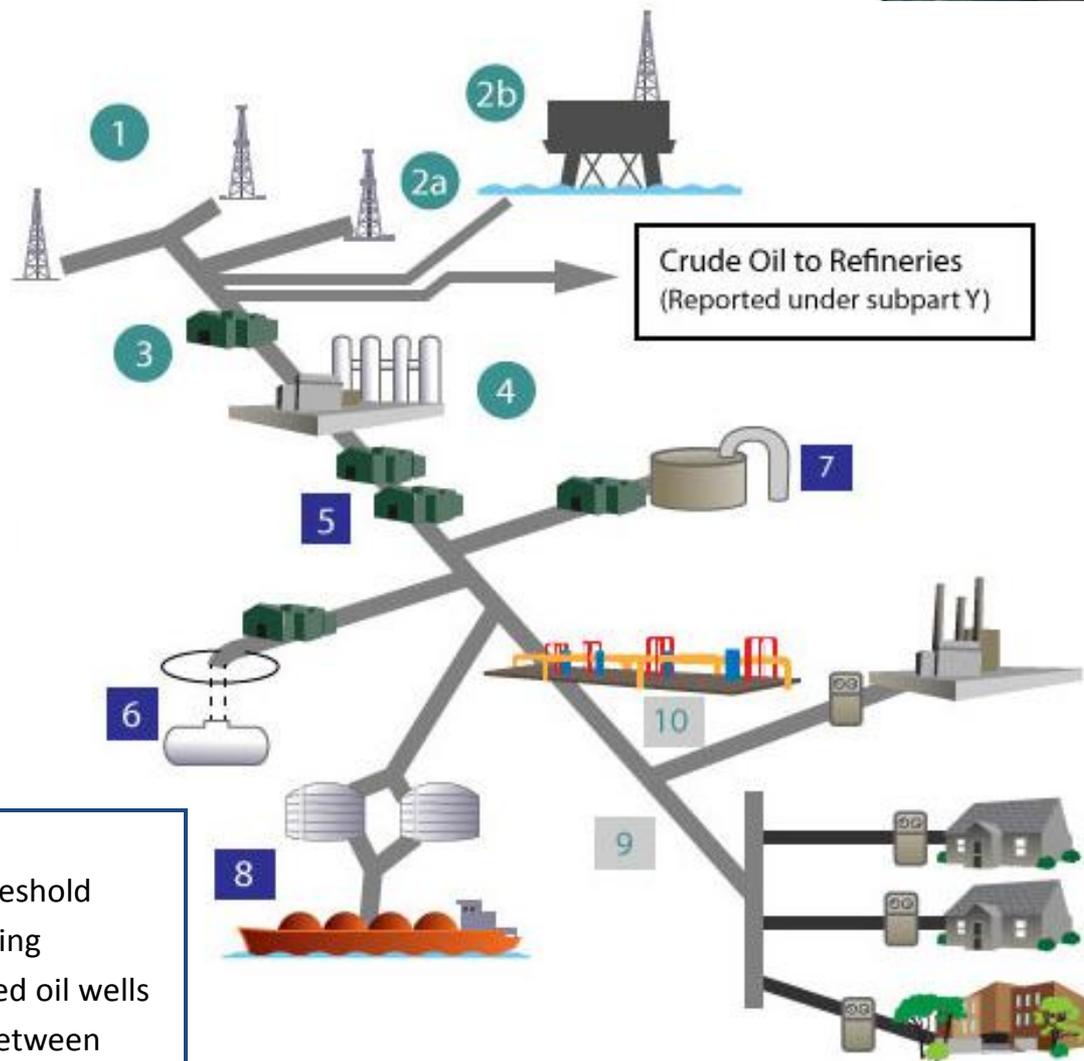
Transmission and Storage

5. Natural Gas Transmission
6. Underground Natural Gas Storage
7. LNG Storage
8. LNG Import-Export



Distribution

- 9, 10. Natural Gas Distribution



Not Covered

- Emissions below 25,000 metric ton CO₂e threshold
- Process emissions from gathering and boosting
- Vented emissions from hydraulically fractured oil wells
- Process emissions from transmission lines between compressor stations

Figure adapted from AGA and Natural Gas STAR

GHGRP in GHG Inventory



- **QC of Key Updates**

- Data from GHGRP used to check Inventory updates under consideration
- Considerations for comparisons between the Inventory and GHGRP
 - Coverage—(e.g., reporting categories, thresholds in GHGRP versus national coverage)
 - Methods—(e.g., use of U.S.-national factors in Inventory versus facility-level emission calculated with direct measurement, engineering calculations, and/or emissions factors)

- **Liquids Unloading update to 2013 Inventory**

- 2012 Inventory total emissions significantly higher than GHGRP results
- 2013 Inventory updated to use API/ANGA data, GHGRP data used as to check new data sources and updated emissions totals

- **Hydraulic Fracturing**

- 2013 Inventory total emissions higher than GHGRP total emissions
 - GHGRP data show more RECs and flaring than GHG Inventory
 - GHGRP data show similar activity data (# of completions)
- 2014 Inventory used GHGRP data to update HF emissions methodology with practice-specific factors instead of potential factors

- **Future**

- Refineries and review of other sources
- Activity data available in 2015

Updating Estimates for Future GHG Inventories



- Enhancing the US Greenhouse Gas Inventory is a key part of the Climate Action Plan Strategy to Reduce Methane Emissions
 - Incorporation of GHGRP
 - Work with USDA and DOE
 - Promoting transparency and stakeholder input
- Evaluation of updates to estimates key to maintaining GHG Inventory quality
 - Continuous improvement - if better data become available, IPCC good practice and UNFCCC obligates its consideration
 - Emphasis on improving estimates and devoting resources to large sources, or rapidly changing sources (“Key Sources”)
 - Annual reassessment of methodologies and refinements for each source category
- EPA notes updates under consideration in “Planned Improvements” section of Inventory

Planned Improvements for Future Inventories



- Continued review of GHGRP data
- Continued review of external studies (e.g. EDF, GTI)
- Updates to uncertainty analysis
- Gas STAR reductions
- Gas well completion and workover counts
- HF Oil well completions and workovers
- Pneumatic devices
- Petroleum refineries

Methane Measurement Studies



- Several recent studies have measured emissions at the source level and at the national or regional level, with emissions estimates that differ from EPA's estimate of emissions
- EPA is considering how such measurement studies can be used to update Inventory estimates.
- Some factors for consideration
 - Attribution—including calculations and assumptions regarding natural sources of emissions and other emissions that are not the target of the study
 - Whether measurements taken are representative of all natural gas producing areas in the United States
 - What activities were taking place at the time of measurement (general operating conditions or high-emission venting events)
 - How such measurements can inform emission factors and activity data used to calculate a time series for national emissions

How to Access GHG Inventory Oil and Gas Emissions Data



- Detailed source descriptions, methodologies, emissions data and activity data available at
 - Energy Chapter of GHG Inventory (pages 3.54-3.75)
 - <http://www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2014-Chapter-3-Energy.pdf>
 - Annex 3 of GHG Inventory (pages A.175-A.208)
 - <http://www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2014-Annex-3-Additional-Source-or-Sink-Categories.pdf>
- Data tables will be available at
 - <http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html>

How to Access GHGRP Data on Petroleum and Natural Gas Systems



- EPA has several data portals to access data collected by the GHGRP on Petroleum and Natural Gas Systems
- EPA's easy-to-use Facility Level Information on GreenHouse gas Tool (FLIGHT) allows users to view GHG data from Petroleum and Natural Gas Systems in a variety of ways
 - View GHG data reported by individual facilities
 - Aggregate reported emissions based on industry segment or geographic level
 - Search for facilities by name, location, corporate parent, or NAICS code
 - Visit FLIGHT: <http://ghgdata.epa.gov>
- Detailed non-CBI data is available on the Envirofacts
 - Access GHG data on Envirofacts: <http://www.epa.gov/enviro/facts/ghg/search.html>